Amendment to the Claims

This listing of the claims will replace all prior versions, and listings, of the claims in the application:

Claim 1 (Currently amended): An inspection system comprising:

    (a)   a database having stored therein a package an object library;

    (b)   an inspection plan generator coupled to receive information from said database and for generating an inspection plan;

    (c)   an image processing system including an image capture processor and an image processor; and

    (d)   an inspection module, coupled to said image processing system, said inspection module including:

        a learn model processor for learning and saving attributes about the appearance of parts objects and for generating image, structural and geometric models from data gathered;

        an image model processor for applying an image model to detect image properties of an object determining a presence of an object within a region of interest;

        a structural model processor for applying a structural model to determine determining structural features of the object; and

        a geometric model processor for applying a geometric model to detect geometric properties of the object determininga precise location of the object.

Claim 2 (Currently amended): The system of Claim 1 wherein said image model processor comprises:

    an image model; and

    means for applying the image model to an image of an object being inspected to determine if the object part being inspected looks like parts objects that have been seen in the past.

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Claim 3 (Original): The system of Claim 2 wherein the at least one attribute corresponds to one of color or luminance.

Claim 4 (Original): The system of Claim 3 wherein said image model comprises at least one attribute arranged in a fixed spatial manner.

Claim 5 (Currently amended): The system of Claim 1 wherein said structural model processor comprises:~;

a structural model; and

means for applying said structural model to an image of an object being inspected to determine whether a ~part~ object exists in the image that has the same structure as that encoded in said structural model.

Claim 6 (Currently amended): The system of Claim 5 wherein said structural model comprises:

a set of regions; and

a set of relations between predetermined ones of the set of regions.

Claim 7 (Original): The system of Claim 6 wherein a set of relations included in the structural model includes relative color relations between predetermined regions of the structural model.

Claim 8 (Currently amended): The system of Claim 1 wherein said geometric model processor comprises:

a geometric model; and

means for applying the geometric model to an image of an object being inspected to determine ~part~ object placement details.

Claim 9 (Original): The system of Claim 8 wherein said means for applying the geometric model to an object comprises means for searching for one or more edges or one or more

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gradient regions of the object with the constraint that the pattern of the one or more gradients match a top level configuration.

Claim 10 (Original): The system of Claim 9 wherein said geometric model utilizes gradients in at least one of luminance or color to precisely locate the object being inspected.

Claim 11 (Original): The system of Claim 9 wherein said means for searching includes means for simultaneously searching for one or more edges or one or more gradient regions of the object.

Claim 12 (Previously presented): The system of Claim 1 wherein said inspection module is adapted to update one or more of predetermined image, structural and geometric models with models generated by said learn model processor.

Claim 13 (Currently amended): The system of Claim 1 wherein said inspection module comprises:

a background model processor for learning and saving attributes about the appearance of ~~parts~~ objects and for generating image, structural and geometric models from data gathered during an inspection process; and

wherein said inspection module is adapted to dynamically update one or more of predetermined image, structural and geometric models with models generated by said background model processor.

Claim 14 (Original): The system of Claim 13 wherein in response to a new model or set of models being learned for an object, said inspection module substitutes one or more of said new model or set of models for a corresponding model or models in the inspection plan.

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Claim 15 (Original): The system of Claim 12 wherein said new model or set of models include at least one of an image model, a structural model and a geometry model for an object being inspected.

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Claim 16 (Original): The system of Claim 1 further comprising a theta estimator for reducing the range of angles over which a model is applied.

Claim 17 (Currently amended): A method for inspecting an object comprising the steps of:

      (a)   applying a first model having a first set of attributes to a region of interest around the object;

      (b)   applying a second model to the region of interest around the object, wherein the second model has a second set of attributes wherein the second set of attributes differs from the first set of attributes by at least one attribute ~~and~~; and

      (c)   applying a third model to the region of interest around the object.

Claim 18 (Canceled)

Claim 19 (Original): The method of Claim 17 wherein:

      the first model corresponds to one of an image model and a structural model; and

      the second model corresponds to one of a structural model and a geometry model.

Claim 20 (Original): The method of Claim 17 wherein the step of applying the first model reduces the number of parameters considered by the second model.

Claim 21 (Original): The method of Claim 20 wherein the parameters are rotation and translation of the object.

Claim 22 (Currently amended): The method of Claim 17~~18~~ wherein:

      the step of applying a first model comprises the step of applying an image model to the region of interest;

      the step of applying a second model comprises the step of applying a structural model to the region of interest; and

      the step of applying a third model comprises the step of applying a geometry model to

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the region of interest.

Claim 23 (Original): The method of Claim 22 wherein the step of applying an image model comprises the step of applying the image model to a region to determine if an object being inspected looks like objects on which the model has been trained.

Claim 24 (Original): The method of Claim 22 wherein the step of applying a structural model comprises the step of applying the structural model to determine whether an object exists in the region of interest that has the same structure as that encoded in the structural model.

Claim 25 (Original): The method of Claim 22 wherein the step of applying a geometry model comprises the step of applying the geometry model to precisely locate the object and to provide detailed information concerning the placement of the object.

Claim 26 (Previously presented): The method of Claim 17 further comprising the steps of:

(d)   prior to applying the first model, annotating a package library;

(e)   generating an inspection plan;

(f)   implementing a learning process;

(g)   applying the first model to a test data set; and

(h)   applying the second model to the test data set.

Claim 27 (Original): The method of Claim 26 further comprising the step of applying a third model to the test data set.

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Claim 28 (Currently amended): The method of Claim 26 wherein said learning process comprises the steps of:

selecting from a set of model types at least one model for a part an object type;

applying each of the at least one models to one or more placed images of the same part object type;

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computing a placed image score between each of the one or more selected models and each placed image in a region of interest;

applying each of the one or more models applied to the placed images of the same ~~part~~ object type to all paste images of the same ~~part~~ object type;

computing a paste image score between each of the one or more models and each paste image in the region of interest;

computing a separation function to provide an indication of the effectiveness of the model; and

in response to the separation function providing an indication that the model is effective, saving the model for later use.

Claims 29-44 (Canceled)

Claim 45 (Currently amended): An inspection system comprising:

    (a)   an image processing system;

    (b)   <u>an image model processor adapted to cooperate with said image processing system, said image model processor applying an image model to determine image properties of an object;</u>

    <u>(c)</u>   a structural model processor adapted to cooperate with said image processing system, said structural model processor <u>applying a structural model to determine</u> ~~determining~~ structural features of ~~an~~ <u>the</u> object;

    ~~(e)~~<u>(d)</u>   a geometric model processor adapted to cooperate with said image processing system, said geometric model processor <u>applying a geometric model to determine geometric properties of the object</u> ~~determining a precise location of the object~~; and

    ~~(d)~~<u>(e)</u>   a learn model processor, adapted to cooperate with said image processing system, said learn model processor for learning and saving attributes about the appearance of objects and for providing structural and geometric models from data gathered during an inspection process.

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Claim 46 (Original): The inspection system of Claim 45 wherein said learn model processor provides structural and geometric models by updating existing structural and geometric models with attributes generated by said learn model processor.

Claim 47 (Original): The inspection system of Claim 46 wherein said structural model processor reduces the number of parameters considered by said geometric model processor.

Claim 48 (Original): The inspection system of Claim 46 wherein said learn model processor evaluates a plurality of values for a plurality of parameters in each of a structural model and a geometric model and said learn model processor determines which set of values provides an acceptable separation function.

Claim 49 (New): The inspection system of Claim 1, wherein:

said image model processor applies the image model to determine a presence of the object within a region of interest; and

said geometric model processor applies the geometric model to determine a precise location of the object.

Claim 50 (New): The inspection system of Claim 1, wherein:

said inspection module combines outputs from the image, structural, and geometric model processors to make a determination about the object.

Claim 51 (New): The inspection system of Claim 45, wherein:

said image model processor applies the image model to determine a presence of the object within a region of interest; and

said geometric model processor applies the geometric model to determine a precise location of the object.

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Claim 52 (New): The inspection system of Claim 1, further comprising:

a inspection module that combines outputs from the image, structural, and geometric model processors to make a determination about the object.

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